POPULAR MECHANICS

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Growing Banana Trade in Our New Islands

An Industry that Employs Fleets of Small Boats Like Those Shown Above and Has Helped Build Up One of America's Greatest Fortunes

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To Cross the Continent in 84 Hours.
Illinois Building at the World's Fair.
Automatic Chemical Extinguisher.
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SAYS THOUGHTS PRODUCE COLORS.

Remarkable Discovery Claimed by Prof. Gates of Washington.

Every mood and every thought of the human mind has a relatively corresponding color, according to the claims of Prof. Elmer W. Gates of Washington, who is alleged to have made many remarkable discoveries relative to brain cell composition and action. He claims to have invented an apparatus which reproduces in living and varying colors the changing thoughts conceived within the mind. The apparatus consists of a tall glass jar half filled with a colorless solution, and to which are attached two glass tubes, which pass through an opening in its top. One of the tubes has an apparatus which fits over the mouth and the other runs to a glass receptacle containing purified air.

When the apparatus is fitted over the mouth of a person and the breath passes through the liquid and thence to the glass receptacle, the varying thoughts within his mind are reflected in the changing colors of the liquid in the jar, this action being due, in brief, to the effect of the variable chemical properties of the breath upon the solution.

The professor says the invention will be of great value in detecting criminals.

WORLD'S LARGEST GAS FACTORY.

The largest factory of illuminating gas in the world is the one which supplies Paris.

WHY FLIRTING STENOGRAPHERS FAIL

They Are Rewarded With Candy, But Never With Promotion.

By Mrs. Juliet Shumaker, Principal of the Lancaster School, St. Paul, Minn.

The stenographer who, in the mildest and most harmless way flirts with her employer, her fellow clerks, or callers at the office, who is called to the telephone on an average of five times a day by some one to whom she talks in a honeyed voice, and whose giggle is a well known sound in the office, need not be surprised if she is pushed to one side and a man preferred when a responsible duty is to be performed.

Feminine graces will be rewarded with candy and compliments, never with promotion or confidence.

The stenographer who goes into an office expecting to win recognition and compensation on an equality with men must remember first and distinctly that she is not a woman, but a stenographer.

It is all well to talk about a woman's presence inculcating gentleness and courtesy in an office, but a busy man has no time for an extra word; he has no time for the effort to make that word a pleasant one when he does not feel pleasant, and an employe whose presence causes him to depart from his habits of speech and conduct wastes his time and lessens her own value to him.

The glass in York Cathedral, in England, which dates from the thirteenth century, has recently given evidence of a curious disease, says the Canadian Engineer. Small holes have made their appearance and the glass is losing its transparency. It would be interesting to learn whether this phenomenon has been observed anywhere else and what the cause may be.

GRAPHITE IN SUSPENSION.

Methods of Carrying Solids in Lubricating Oils at Last Discovered.

A method of carrying solids in lubricating oils, something that has been sought by chemists for the past 30 years, has at last been discovered and an American is the discoverer. The missing link was in what is known as the channellene process employed by the Monarch Manufacturing Co., of Council Bluffs, Ia. By this method the company combines graphite or plumbago with engine, cylinder, machine and lubricating oils in general. A member of the company states:

We carry graphite in suspension without precipitation. The practical man will realize at once what results can be obtained by carrying the graphite or plumbago into all bearings and into steam cylinders. The smoothest bearings and the cylinders on the finest engines when looked upon through a microscope seem rough, full of ridges and hollows. The channellene oils deposit the graphite into these uneven places until the entire surface is absolutely perfect. When this result has been obtained, very little lubrication is necessary, as the friction has been almost entirely eliminated.

SERUM CURE FOR HAY FEVER.

Dr. Dunbar, an American from St. Paul, who is a medical professor in Germany, and himself a sufferer from hayfever, announces a cure for this annoying affliction. He believes it is caused by a poison which floats in the air from certain plants and grasses. This poison ceases to work when the patient is removed to places where it does not exist, which theory is borne out by hayfever victims. The doctor has discovered an antidote for the poison in a serum which, when injected, kills the poison and the attack ceases.

Banana Reapers. (Bread Fruit Tree in the Background.)

Down Where the Sweet Bananas Grow

Story of How the Now Wealthy and Powerful United Fruit Co. Came Into Existence

Down where the bananas grow scenes like these herewith shown are as common as loads of hay and corn on the farms of the United States. A wealth of fine banana lands has come to Uncle Sam with the possession of the new islands. Great interest is now being taken in the cultivation of the fruit and the advancement of the trade which is becoming more important every day. It used to be that the Cubans and Porto Ricans didn't consider the banana of much commercial importance. Here is an interesting story on the subject from Tropical Truth:

The Original Banana Schooner, Formerly Run by Capt. Baker, Now Head of the Great United Fruit Company.

It was when the islands were on the verge of financial collapse on account of the sugar crisis. Day after day the sun rose on the palm-clad islands and lighted on the surging fields of sugar cane, and the noiseless, smokeless, deserted sugar mills. The natives practically subsisted on bananas, which they grew and sold to one another. An American sailor who was running along the coast with his schooner looking for a cargo—of anything—took it into his head to fill the hold with bananas. He did so, and the cost to him was next to nothing. The bananas were eagerly bought in this country at high prices. In a very short time the Boston Fruit Company was formed, and acquired large tracts of banana lands in Costa Rica, Columbia, Cuba, Santa Domingo and Jamaica. The company is now known as the United Fruit Company and at its head is the skipper of "the original banana schooner," Captain Baker.

The banana plant is grown from "suckers," or offshoots from the root of the old tree, after the manner of the common potato. While the main stem is flourishing those "eyes" are allowed to grow in twos or threes, according to the fertility of the soil, so that when the fruit is cut from the first plant, the others yield at intervals of three months thereafter. The entire period from the sprouting of the sucker to the cutting of the fruit is from 12 to 14 months.

Waiting for the Steamer

In establishing a plantation, the suckers (which can be obtained at a cost of from 3 to 6 cents apiece) are planted at from 8 to 16 feet apart; the distance varying according to the fertility of the soil. The main expense lies in plowing or, where the land is rough, in forking and weeding the plants. The more attention paid the young bananas the more liberal in size are the bunches in response.

The front page illustration is from a photograph taken by the Dominion Co., showing the traffic in bananas at Bluefields, Nicaragua.

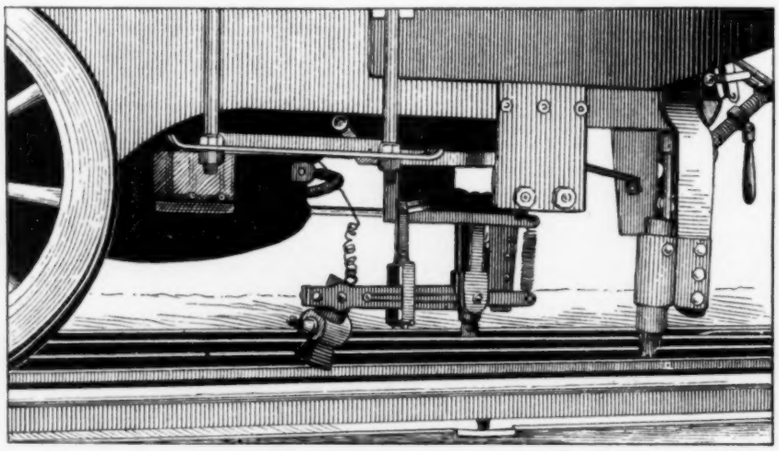
What we want just now is not a perfection of Edison's scheme for making electricity direct from coal, but rather how to make coal from electricity.

MAKES COLLISIONS IMPOSSIBLE.

Remarkable Railway Safety Device Satisfactorily Tested in Germany.

By Frank H. Mason, United States Consul at Berlin, Germany.

The new electrical device for preventing collisions between railway trains in Germany, mentioned in the press telegrams of the American newspapers, is truly an important effort. In effect it puts the engine driver of every train into instantaneous touch with other trains, switchmen and station and crossing keepers in his neighborhood and keeps ever before his eye and ear an automatic and infallible signal which springs into activity the moment that his locomotive, whether running forward or backward, comes within the radius of danger from collision.



THE THIRD RAIL AND CONTACT SHOE.

The German government has directed that a section of track be equipped with the apparatus for careful, practical experiments, and it is reported that the government of Russia has obtained license to test it in actual service on its new military lines now under construction in Siberia.

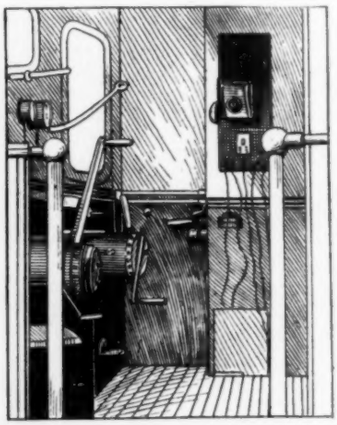
The construction and operation of the device is as follows: Midway between the rails is laid a light third rail of the ordinary T-pattern, the joints of which are so connected as to form a continuous conductor.

Midway under the forward part of the engine is hung the working instrument, an electrical apparatus inclosed in a square case or jacket occupying a cubic foot of space. The instrument is connected with a contact shoe, which slides along the third rail and by wires with a telephone and electric alarm bell in the cab of the engine driver, and a red incandescent lamp which is lighted by the same impulse that rouses the alarm bell into action. A further improvement of the device sets the electric brakes on the engine or entire train simultaneously with the alarm signal which sounds the bell and lights the lamp. The apparatus is so adjusted and arranged that the engineer can at any moment, by touching a lever, satisfy himself that it is in full working condition.

The tests on November 12 were conducted on the main line from Frankfort to Hanau. Two locomotives, numbered respectively 290 and 1420, had been equipped with the new device. Engine 290, drawing a special train and approaching Sachsenhausen at full speed, received the danger signal and came to a full stop; the driver of 290 then asked by telephone the cause of the signal and received from the keeper of a grade crossing, half a mile in front, word that a wagon had broken down in crossing the track and obstructed the line. After ten minutes' wait, the engineer of 290 received word by telephone that the obstruction had been cleared away and thereupon resumed his trip.

A mile farther on, the signal on 290 again sounded, and the driver was informed, by telephone as before, that the semaphore round a curve and more than half a mile distant was set at "halt." Thereupon engine 290 slowed down and proceeded cautiously, sounding its whistle at short intervals, the telephone bell in the drivers' cab ringing continuously until the curve was rounded, when the ringing ceased, notifying the engineer that the semaphore had changed to "track clear." Thereupon 290 resumed full speed.

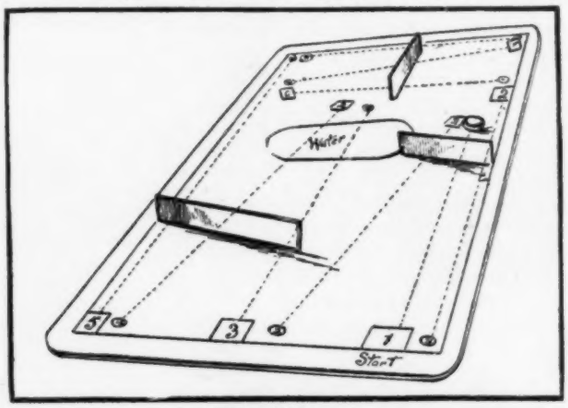
In the tests to prevent collision, engine 1420 came up rapidly from behind and on the same track as 290, which had slowed down and was proceeding cautiously in consequence of reported danger in front. The moment that 1420 came within 1,000 meters (1,093 yards) of 290, the signal on both engines began to ring and their red lights to glow. Thereupon 1420 halted, the driver inquired of 290 in front the cause of the alarm, and a complete understanding between the two trains was immediately established. An important point in this connection is that in practice the same warning signal is sounded upon every engine equipped with the apparatus which is on the same track and within the prescribed radius—a kilometer or a mile, as the case may be—from the engine and train which cause the obstruction. If a semaphore be falsely set at safety, the train may run past it into a block in which another engine is halted or moving with perfect security that warning will be given in ample time to prevent a collision under any and all conditions of darkness, fog, storm, or mistaken instructions.



Telephone, Alarm Bell and Red Light in Engine Cab.

GOLF IN THE PARLOR.

Wintry winds will no longer hinder the golf fiend from revelling in his favored sport. An inventor has fashioned all the necessary paraphernalia so that golf may now be played in the parlor with all its alluring features, save the "walk-a-mile" after you hit the ball. The apparatus consists of a board, a cup and obstructions which represent bunkers. The board is of flexible fabric, and has no elastic surface, and on it are marks indicating a golf course. The cup represents one of the holes and extends above the surface of the board, and later, when not in use, is so constructed that it can be rolled or folded into small compass. A disk is used instead of a ball, and the aim of each player is to get it over the course and obstruction and into the cup. Croquet, cricket and even baseball have been played in parlors and there is no reason why golf should not prove equally attractive.



Parlor Golf Game

The staff of the Bank of France consists of 1,093 employes at the central office, and 1,341 at the various branches.

MINER'S VIEW OF SUBWAY WORK.

Says Diggers of New York Tunnel Could Get Pointers From Any Practical Mining Man.

By W. F. Wood, Superintendent of Gagnon Mine, Butte, Montana.

I have just returned from New York, where I spent some time examining the much talked of phenomenal engineering feat of digging the tunnels for the New York subway. As an old-time miner, accustomed to boring in the ground, of course I could not help being interested in how this work was being done in the metropolis. I must say that I was not greatly impressed with their style of procedure I believe that the contractors and superintendents of that big job could come to Butte and learn something from almost any practical mining man. It seems to me that they go about it in the most impractical and expensive way. I noticed particularly on one contract that instead of cutting down and getting a face on the work and then drilling horizontal holes for blasting, they were drilling vertical holes in the top of the rock. This scales off the rock, the blast being anything but effective, whereas a blast put in horizontally would throw down twice or three times the amount. Then there are so many men massed together that they are in each other's way. I believe the contractors are to receive something like $35,000,000 for this work, and if they make a reasonable profit at this figure they might increase it if they did their mining according to the Butte method.

Bids have been asked for the establishment of a sewerage system in Belem, Para, Brazil.

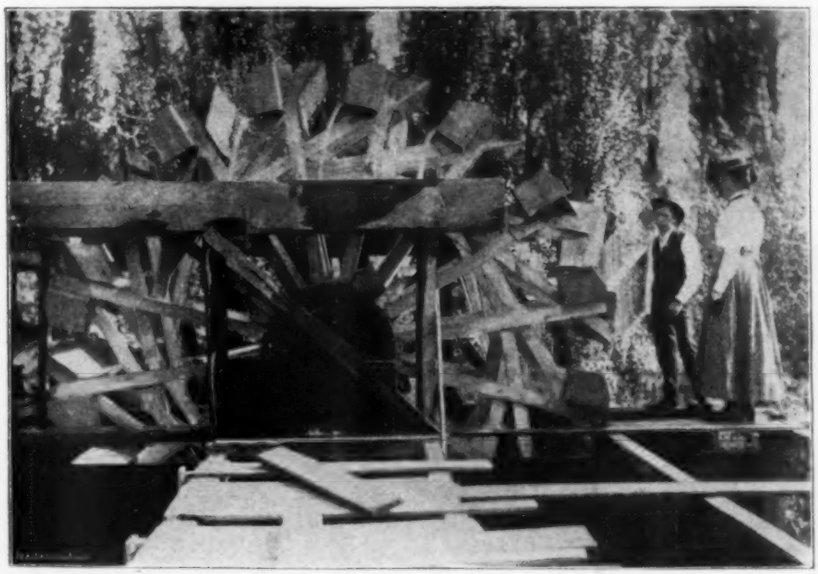
Smallest Irrigation Plant in the World

Unique Methods of Watering the Land on Vineyards and Fruit Farms in California

On the new vineyard of R. W. Briscoe, near Malaga, Cal., is an irrigation plant which is believed to be the smallest and is certainly one of the most unique in the world. A 6-inch centrifugal pump is set in a pit directly over the well and ten feet below the surface of the ground. The well is bored 56 feet deep and is cased with 12-inch casing. A gasoline or oil engine, shown in the accompanying illustration, is connected by belt to the pump and furnishes the power. This diminutive plant irrigates a thriving vineyard of 240 acres. The pump may be started at any time it is desired to use water on the field. The water rises in the well so that when the pump is running at full speed it lifts water 30 feet and throws from 1,000 to 1,200 gallons of water per minute at a cost of 6 cents per hour for fuel oil. The well is located at the highest point of the grounds which it irrigates. Water can be easily conducted over the land from this point, thus avoiding the expenses of constructing independent laterals from the supply ditch to the vineyard.

Another interesting method of irrigation is found on California fruit farms, and is shown in the second illustration. This type of water wheel is used on knolls or small tracts which are too high for irrigating from the supply ditches. To the large wheel is attached buckets which as the wheel turns, pick up the water from the supply ditch and empty it into a small flume, which conveys the water. The wheel operates on the same principle as the one used in Mexico described in the April 26, 1902, issue of Popular Mechanics. The wheel is adjustable to the height of water in the ditch, says the Irrigation Age, the well-known authority, and, of course, raises water without expense after it is once installed.

Pumping Plant of R. W. Briscoe, near Malaga, Cal.



Pumping Wheel, Sunny Side Fruit Ranch, near Fresno, Cal.

THREADS USED IN SURGERY.

Modern surgery employes dozens of different kinds of thread for sewing up cuts and wounds. Among them are kangaroo tendons, horsehair, silk and very fine silver wire. Many of these threads are intended to hold for a certain number of days, and then naturally break away.

The short, tough tendons taken from the kangaroo, which are used for sewing severe wounds, will hold for about four weeks before they break away. Silk threads will hold for much longer, sometimes for six months, while the fine silver wire is practically indestructible.

With the entire outfit a surgeon is able to select a thread that will last as long as the wound takes to heal and will then disappear completely. To accommodate this assortment of threads special varieties of needles are required.

Besides the needle craned in different segments of a circle, surgeons use needles shaped like spears, javeline and bayonet points. Some of these are as long as bodkins, with a point like a miniature knife blade. Others have the sharpened end triangular.

The city of Santos, Brazil, is to have an electric traction system which is to be operated with American machinery.

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SAFE SPEED OF CAST IRON WHEELS.

The following table compiled by the Fidelity Casualty Company gives the number of revolutions per minute wheels of various sizes must make to give a rim speed of a mile a minute, which is considered the limit of safety.

For cast iron wheels as ordinarily constructed a rim speed of a mile a minute is the limit of safety. This is, too, the practical limit of belt speed. The following table gives the number of revolutions per minute at which wheels of from 1 foot to 30 feet must run to have a rim speed of 5,280 feet, or one mile, per minute.

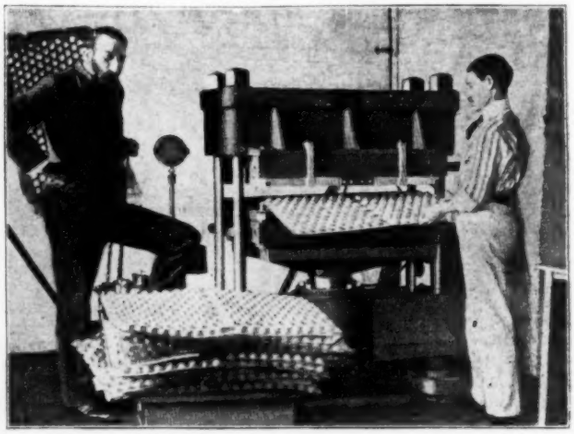
Diameter of wheel in feet.	Revs. for 1 mile per minute rim speed.	Diameter of wheel in feet.	Revs. for 1 mile per minute rim speed.
1	1680	15½	108
1¼	1344	16	105
1½	1120	16½	102
2	840	17	99
2½	672	17½	96
3	560	18	93
3½	480	18½	91
4	420	19	89
4½	373	19½	86
5	336	20	84
5½	305	20½	82
6	280	21	80
6½	258	21½	78
7	240	22	76
7½	224	22½	74
8	210	23	73
8½	198	23½	72
9	187	24	70
9½	177	24½	68
10	168	25	67
10½	160	25½	66
11	153	26	65
11½	146	26½	63
12	140	27	62
12½	134	27½	61
13	129	28	60
13½	124	28½	59
14	120	29	58
14½	116	29½	57
15	112	30	56

An immense ore range, with 180,000,000 tons of ore in sight, has been discovered near Sault Ste. Marie.

HOW PING PONG BALLS ARE MADE.

American Method, Which is 100 Times as Fast as the British, is Still Too Slow.

While the English are making ping-pong balls one at a time, the Americans are turning them out in plates of 220 half balls at one operation, as shown in the accompanying illustration. It takes less than two minutes to make one of these plates, which means 30,000 balls per day through one press alone. This is 100 times as fast as the English method, but even this is entirely



Making Ping-Pong Balls

too slow for the American inventor of the process, John Whitehouse, and he now has in view an improved process by which a machine will make 125,000 balls a day.

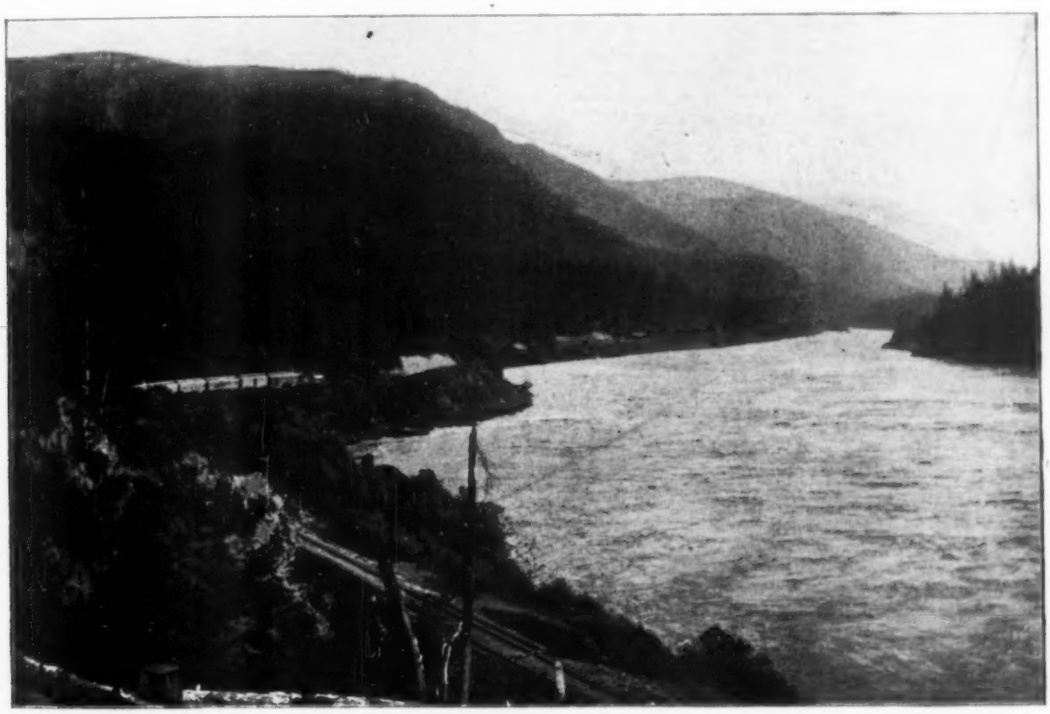
The balls are made of celluloid. In the process a metal female die and a male die made of paper were necessary that they might obtain the proper clearance according to the stretch of metal. A writer in the American Machinist says: The celluloid is held in a frame by its edges and becomes a diaphragm, and as such it is placed over the die and becomes a packing ring. The female die is virtually movable and is lowered from the diaphragm of celluloid to be embossed. The air is exhausted from the female die and it is then brought back to its original position to be in contact with the celluloid. In this way a partial vacuum takes place in the die. The upper half of the machine is brought down on the celluloid and through a packing ring it is hermetically sealed on its outer edge. It is now ready to be embossed. Compressed air at a temperature of about 220 degrees Fahr. and with a pressure of 100 pounds per square inch is admitted. The celluloid through the heat and pressure instantly stretches into all the cavities, no matter how deep.

A NEW METHOD OF EXTRACTING FOREIGN BODIES FROM THE EAR.

There is no more delicate and even difficult task, so states the Medical Press, than the removing of a foreign body from the ear. Pouring in water often fails to bring it away, and in certain cases adds to the difficulty by causing the object, a pea for instance, to swell and become more firmly fixed. The employment of instruments is very painful and requires considerable dexterity, besides supposing an outfit specially designed for the purpose, which few general practitioners possess. The recommendation is made of a piece of soft rubber tube, the length of a cigarette and of the proper size, to be introduced into the ear. The end of the tube is dipped in paraffin and pushed into the ear until it comes in contact with the foreign body, whereon the operator, applying his mouth to the free end, draws the air from the tube, at the same time throwing back his head. This method is usually attended by success, the body coming away with the tube.

ASTORIA, "WHERE THE SALMON COME FROM."

Astoria, "where the salmon come from," made such wonderful progress during the past year as to claim rank to being one of the leading cities of Oregon and the Pacific coast. Whenever you eat salmon you ought to think of Astoria, for this city is right in the center of the greatest salmon country in the world. Here are located the great Columbia river salmon canneries and salmon that come from all along that stream for many miles find their way into these immense factories. Astoria is named for John Jacob Astor, its founder, who as early as 1811, when he selected the site of the town, predicted that it was to become one of the greatest of western seaports. The salmon industry of Astoria now amounts to about $4,000,000 a year. Here there are 4,000 men employed in this industry alone. The Morning Astorian, an enterprising newspaper of Astoria, published on Jan. 1 an interesting special edition containing some surprising revelations regarding this rising city of the far west that ought to make people interested in the country's development open their eyes to the conditions in this section of Oregon.



The Columbia River, the Stream that Literally Swarms with Salmon

SAYS "IT TAKES THE CAKE."

Editor Popular Mechanics: I have some 25 boarders, among them merchants and professional men, and they can hardly wait from one week to the next to see your paper. It takes the cake over all others.—S. L. Baker, Williamsport, Pa.

Motor Cars to Displace Locomotives

Automobile Trains on Tracks to Do Away with the Iron Horse and Add to Our Comfort and Convenience

The automobile train has come. The first important blow has been struck at the steam locomotive and the future may effect its abolition. France and England have started the innovation. Auto cars for the new service are being built by the Northwestern railroad of England. The first automobile train in France will start in a short time from the Lyons station in Paris. It will be composed of three cars, and will run between Paris and Dijon. The distance of 195 miles is to be covered in three hours and ten minutes or at a normal speed of 62 miles an hour. The same speed may be maintained between Dijon and Lyons, Lyons and Marseilles, Marseilles and Nice and Calais and Paris uninterruptedly, so that the distance between Calais and Nice may be covered in 14 hours.

The London Times says: "This invention is now neither a project nor an experiment, but exists and works, and its application is merely postponed for some months for the construction of the actual rolling stock. As its name indicates, the automobile supersedes the locomotive—that is, dispenses in every train, short or long, slow or fast, with a weight of 110 tons. It saves the considerable cost of locomotives. It abolishes smoke, steam, noise, vibration, the jolt incidental to stopping and starting, and the necessity of stopping to take up water. It also abolishes all the men in charge of a locomotive except the engine driver. The new carriage is 17 meters (56 feet) long—that is to say, the length of the present corridor carriage. Of these 17 meters, a space of 2.6 meters (8.5 feet) in front is occupied by the traction apparatus, while the remaining 14.4 meters (47.5 feet) will comfortably accommodate 40 passengers and the 1,200 kilograms (2,645 pounds) of luggage allowed them. The cost of the autonomobile is the same as that of the first-class corridor carriage, while the weight, including the traction apparatus, is also the same. Thus the abolition of the locomotive is an accomplished fact, and the rails which now have to bear the weight of the locomotive and tender as well as of the carriages are relieved therefrom."

DEVICE TO COOK VEGETABLES WITHOUT SMELL.

A well-known Chicago physician whose recreation is along mechanical lines, has constructed a very simple, inexpensive but very successful cooker for onions, turnips, cabbage and the other vegetables by which they may be boiled without the usual malodorous accompaniment. Some enterprising manufacturer of such specialties ought to make a fortune with it. We have seen it in operation and it's a positive success.

The generating plant of the Northern California Power Company at Cow Creek in the high Sierras, furnishes current from that and another station for ore smelting, for operating air compressors, for town lighting, for water works and for the irrigation of land.

Merida, Yucatan, is to have the first cotton mill in that part of the world. The machinery will be brought from the United States and the supply of cotton will be drawn from New Orleans and Mobile.

CAUGHT A WHOLE ROPE OF EELS.

One Cosmos Eckensode was fishing in the Tulpehocken when a migrating band of "tandem eels" chanced to pass by. The peculiarity of this variety is that when they are making for their winter or summer quarters they move like the aborigines—in single file, at a distance of exactly six inches apart. When any eel in the procession sees that his immediate predecessor is lengthening the space, it at once darts forward, catches the other's tail in his mouth and jerks it into his legitimate position. When migrating these eels seldom stop to feed, but as Cosmos's bait dropped quickly in front of one of them it took it in, was hooked, and Cosmos gave his pole a jerk. The following eel, true to the "tandem" instinct, seized its tail, and was drawn rapidly away from eel number three, which also obeyed its instinct, and so on with all the others.

Cosmos very soon found that he had caught a rope of eels, and, dropping his pole, he hauled it in, hand over hand, until the ground all around him was a writhing mass and he, completely exhausted, was obliged to cut the "rope." Then he ran to the nearest farmhouse for assistance, and from it word was sent to the neighbors, who hastened to the scene with their wagons. The total weight of the "tandems" was 850¼ pounds, Piscatorially.

Next time Cosmos should fish with a windlass, or confine his drinks to water.

OILING ROADS IN ENGLAND

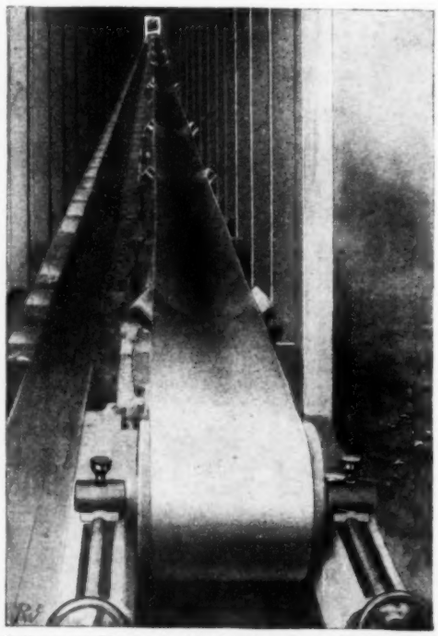
Recently a section of the main road at Farnborough, near Aldershot, England, was treated with oil, and a few days later a party of road experts and automobilists paid a first visit of inspection. The experiment, though only in an initial stage, promises a great success.

The Newport News shipyard has placed a dozen young women at work as tracers. Should the experiment prove successful 100 more young women will be put to work immediately.

A stone is 14 pounds.

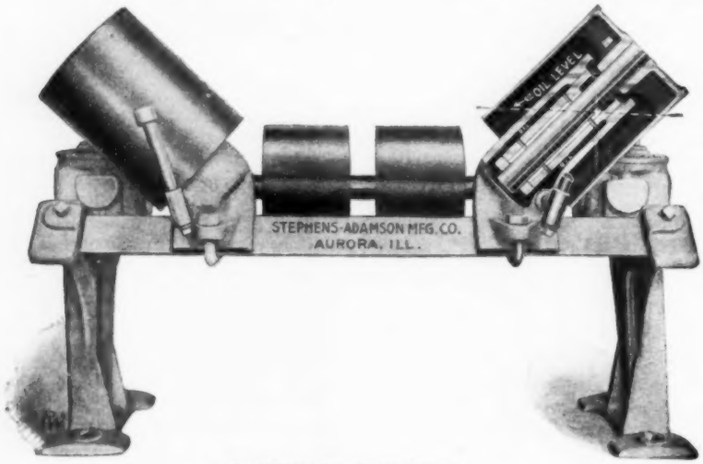
PILL-BOX FILLER.

A device for filling pill bottles and boxes has been invented by Ernest Thulin of Moline, Ill. All that is necessary is to connect a bin with the new device and the machine fills and counts 100 pills to the bottle or box, and has a capacity of 40 bottles a minute.



Belt Conveyor More than 600 Feet Long and 18 Inches Wide Used for Carrying Coal

The Transatlantic "combine" will respect the old superstition about going to sea on Friday and will have a passenger steamship leave New York every day in the week except Friday and Sunday.



Self-Oiling Dust-Proof Carriers

LONGEST BELT IN THE WORLD.

Conveyor Belts, Because of Their Economy and Convenience, Are Supplanting Tramways.

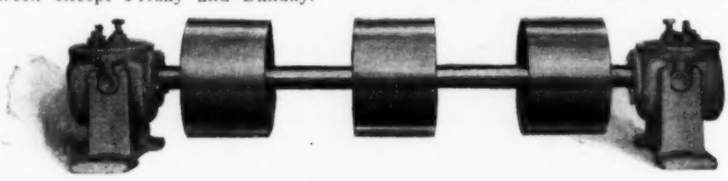
The method of conveying materials in large plants by means of belts is growing in popularity and rapidly supplanting other systems. Its use has broadened until now it is even doing away with narrow gauge cars and tracks in many large mines and factories. The belts are huge affairs that are very wide and often attain enormous lengths, as in the case of the one shown in the accompanying illustration, the longest belt in the world. This system is made by the Stephens-Adams Company. Speeding along at a rapid gait, this endless car, whose path is 200 yards in length, accomplishes an enormous amount of work in the course of a day. The capacity may vary from a few hundred to 20,000 bushels per hour, according to the width and speed of the belt.

The belt conveyor systems now so generally in use, consist of an arrangement of conveying belt, similar to that shown in the illustrations, a head pulley, tail pulley, carriers and return rollers, stands, bearings, shafts and take-ups; also such auxiliary appliances as may be required by existing conditions, such as discharging tripper, loading hoppers, swinging belt loaders, spouts, gates, etc.

There are numerable advantages that tend to make this an ideal system for conveying almost any kind of material among which might be mentioned the wide range of application for different classes of material, small liability of break-downs and the automatic features. The belts run on adjustable carriers which have troughing rollers that may be gauged to different pitches as desired for different uses.

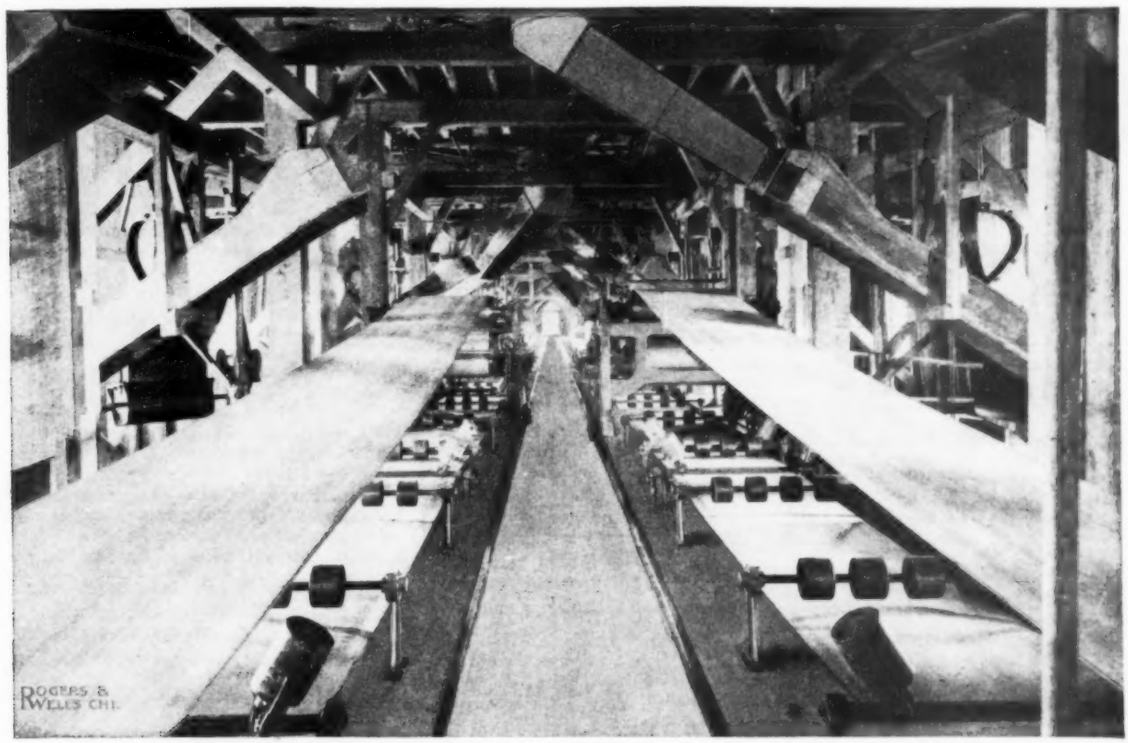
The more desirable carriers are made with independent troughing and supporting rollers, which eliminate the wear on the conveying belt and permit great conveying capacity.

The usual method of driving the conveyors is from the head or discharge end, thus



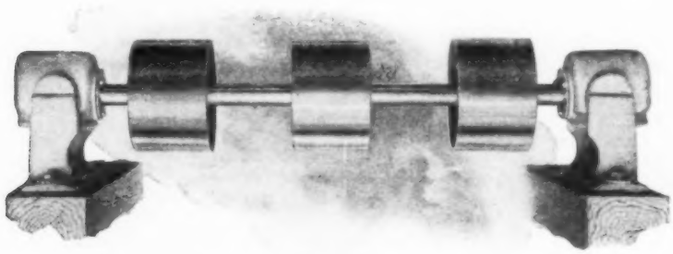
Return Rollers

bringing a pull on the conveying belt. The power, however, may be, and often is, applied at the tail end. Practically all the power required is that sufficient to move



Showing Two Conveying Belts with Reversible Four-Pulley Trippers—Material is Received from Hoppers Located Over the Belt

the belt over the head pulley and carry the material on the belt. There is less frictional loss of power in the belt conveyor system than in any other conveying method. The speeds of grain carrying belts often run up to 900 feet per minute.



Self Oiling Return Rollers

The treasurer of the United States says there may be some peril in the inflow of gold, but it will be hard to convince any single individual that it can come his way in too large quantities.

The Canadian Pacific Railroad has found it necessary to place in Europe an order for new equipment owing to the overcrowded condition of the American locomotive builders.

DOES GOLD GROW?

Does gold grow? Many arguments can be produced to prove that it does. Its growth is of a nature, however, that will hardly warrant the planting of a field of gold dollars with the hope of reaping a harvest of twenty-dollar gold pieces in an after time. But it has been found that gold nuggets under favorable conditions actually increase in size. Gold is known to have grown on mine timbers which have long been immersed in mine water. In the California State Mining Bureau museum there is a speciment of a piece of jointed cap and post taken from the Comstock, where it had been under water for years in which gold has formed in the joints and pores of the wood. Gold is constantly being formed in rocks and veins and placers. Just what it is that the baby gold formaeion feeds on to effect its growth is not known; if it were, a new and wonderfully lucrative industry might be born and all other kinds of farming save the growing of gold might temporarily be abandoned. The formation and growth is due to mechanical and chemical action. As in the case of the animal or vegetable, existing gold has existed in some other state before assuming its present form. Waters which percolate through the earth's crust are said to contain substance from which gold is formed. Thus gold, like the animal and vegetable, must have water in order to thrive. The gold in the water is deposited when it meets the proper precipitant. The precipitant may be an earth current of electricity, some vegetable growth or chemical in the rocks. It has been claimed that the nuggets found in placers are the formations from the waters that percolate through the gravels and are not from decomposed quartz as generally supposed. Those who so contend cite the fact that in the center of nuggets can be often found a small grain of iron sand. This was the nucleus around which the earth current of electricity created or deposited gold from the substance in the waters, just as it is deposited in electroplating. During long ages this influence was at work causing the gold to form around the little grain of iron ore and then grow to become a bright, shining nugget of gold much larger and purer than any ever found in the veins of ore.

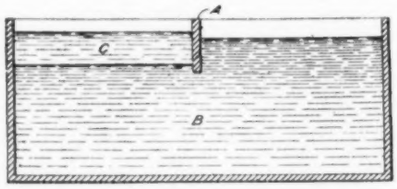
A fathom (nautical) is 6 feet.

SHOP NOTES

NOVEL OIL BATH.

Government Method of Avoiding Atmospheric Exposure.

In the work of hardening and tempering steel, slight changes of temperature have a very important effect upon the results obtained, says Steam Engineering. Besides there must be taken into account the



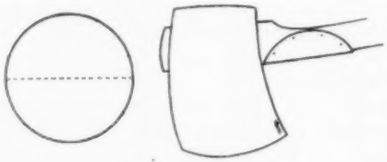
COMBINED WATER AND OIL BATH.

qualities of the different makes of steel, some of which soften far more readily than others. The form of the pieces also has an important influence upon the hardening; points and edges may be made very hard, when a surface with a body of metal behind it may not be hardened at all.

In one instance where some work was being done for the government a large quantity of work was rejected on account of the existence of surface cracks due to hardening. The method pursued in doing this work has been to dip in water and then lift the pieces out and plunge them in oil. After their rejection on account of surface cracks a tank like that shown in the accompanying engraving was used. The top of the tank was divided by a partition A. The bottom and the space on one side of the partition were filled with water B, while the space on the other side C of the partition was filled with oil. The pieces were then sent down into the water, carried beneath the partition and brought up through the oil. In this way there was no chance for delay in transferring from the water to the oil bath and the surface cracks, which had previously caused the rejection of the work, entirely disappeared.

TO SAVE AN AX HANDLE.

A simple device to save an ax handle from wearing out at the weakest point is herewith shown. It is very easily made



Ax Handle Protection

by taking the end of a tin can, bending it at the dotted line and tacking it on the handle at A. It will well repay any one for the time and trouble.

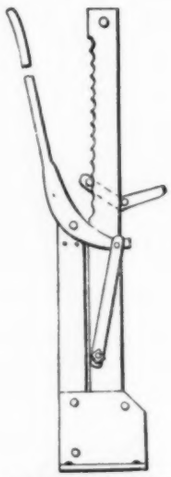
The steamer Breakwater, of the United Fruit Co.'s fleet, has made a successful test of oil and is now using it regularly on trips between New Orleans and Central American ports.

HOW TO MAKE A WAGON JACK.

Simple and Useful Device That Will Lift a Wagon Containing 400 Pounds.

The wagon jack, herewith described, is the best thing of its kind I ever saw, says a writer in the American Blacksmith. It weighs 16 pounds and will lift a wagon with 400 pounds on it. I sell them for $2.50 with a fair profit, so it is an excellent thing for a smith to know how to build. I make them of steel, with the exception of the lever.

The jack is shown in the cut. The base is formed of two ⅛-inch plates, 4 in. by 6 in., bent, punched and riveted as shown. This base supports two uprights, one movable and 25 inches long, the other rigidly attached to the base and 14 inches long. Each of these two parts is made double, out of 3-16 in. by 1½ in. soft steel. The lever is made with a forked end, and



SIDE VIEW OF WAGON JACK.

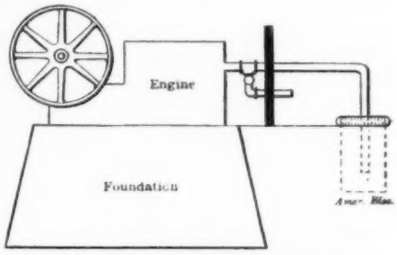
is pivoted on a steel pin running through the upright. The lever crotch is of tire steel ¼ in. by 1¼ in., having a ⅝-in. round handle 24 inches over all. The end of the lever connects by two links, 3-16 in. by ¾ in., with the movable upright. Both bars of this upright are notched as shown, to prevent the slipping of what I term the shifting dog when the jack is loaded. This dog is made out of tire steel, 1¼ in. by ¼ in., with two short pins made fast by upsetting. To hold the movable upright in place I rivet a piece of iron ¼ in. by ¾ in. between the two parts of the stationary upright, and this has a T-shaped end for holding the movable piece in its proper vertical position. When the handle is thrown down the connecting links should pass by the fulcrum or turning point of the handle lever and thus lock itself.

The Pennsylvania Railroad is to spend $50,000,000 on its New York City terminal, the enlargement of its buildings and yards in Pittsburg and the erection of a new union station in Washington.

Popular Mechanics is "written so you can understand it."

HOME-MADE GAS ENGINE EXHAUST MUFFLER.

A cheap but effective gas engine exhaust muffler, described in the American Electrician, consists of a piece of sewer pipe about 10 inches in diameter and 2 feet long, set in the ground just outside the wall of the engine room, as indicated in the sketch. The exhaust pipe of the engine enters the muffler through a wooden cover,



GAS ENGINE EXHAUST MUFFLER.

which is perforated with a number of 1½-inch holes. A branch is led off from the exhaust pipe and opens into the air, a valve being inserted at the junction of this pipe with the exhaust pipe. This is for the purpose of relieving the cylinder of back pressure at the time of starting up, and also in case the holes in the muffler cover become closed up with snow or ice between the time of shutting down and starting up. After a few explosions, the relief valve is closed. This muffler has been found to suppress the sound of the exhaust almost completely.

Another wrinkle which may be of interest to the reader consists of supplying a small radiator with the water discharged from the water jacket of the engine, thus cooling the discharge water, and at the same time contributing to the heating of the room. The engine to which these features were applied is a 3-horsepower machine, operated by gasoline; the radiator is made up of ½-inch pipe.

UNIQUE ROTARY POCKET MEASURE.

A rotary pocket measure that has made its appearance in Chicago has added much to the conveniences of architects, engineers, decorators, paper hangers, and, in fact, all craftsmen who ever have use for a rule. It is manufactured by the Steckenreiter Mfg. Co., 100 Lake street, Chicago. Its advantages consist principally in its absolute accuracy, its adaptability for measuring spirals, ogees, ellipses, circles or the inside or outside surfaces of round bodies. It is of great service for estimating purposes and as a checking instrument, and will be found quite indispensable to landscape gardeners and contractors.

Setting Pointer to Zero

The rotary measure is simply a revolving rule, and any one can use it. A wheel moves over the surface to be measured and when it has made one complete revolution it has traveled exactly six inches. A pointer on the dial tells how many feet and inches have been measured. The pointer can be set back to zero in an instant as shown in the cut.

Write us about your new invention. Popular Mechanics is the American medium for inventors.

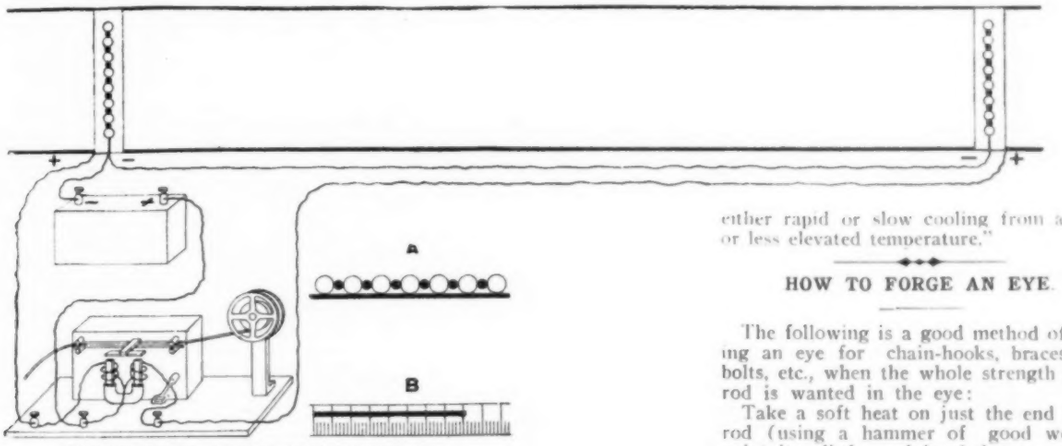
HINTS FOR INVENTORS.

A variable-speed gear for electric locomotives affords unlimited opportunity for ingenious minds who want to invent something for which there is an urgent demand, as yet not satisfactorily supplied.

ELECTRIC TIMING DEVICE FOR AUTOMOBILE RACES.

The Automobile Club of France is using an interesting electrical device to record the speed made in automobile races. An electrical machine operated with a motor and battery is placed at a convenient point Across the road to be traveled is stretched two copper tapes at both the starting point and finish. These two tapes are separated by small hollow rubber balls which will easily compress, allowing the metal tapes to touch each other when a vehicle passes over them. The two tapes are connected by wires to the recording instrument. A similar set of tapes, also connected by wires to the instrument, is placed across the road at the finish point.

When all is ready the instrument is set in motion, which causes a paper ribbon to unwind and pass through the instrument. The instant an automobile passes over the first metal tape in the road the instrument records with a pen on the paper ribbon; and again when the finish is reached. One inch of the paper record equals a certain number of seconds of time travelled on the road and from this record the exact time can be figured to the fraction of a second. In the Cut A is the metal tape in the road, and B shows a piece of the paper ribbon.

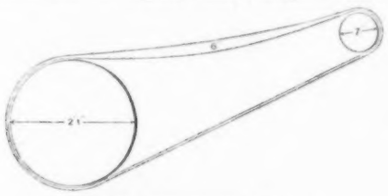


Electrical Device to Record Speed of Automobiles

WORKING DOUBLE BELTS.

Where a belt must turn over small pulleys at high speed it is sometimes advisable to use double belts and it is claimed that two thin, wide belts will give better service than a single stiff one would, says the American Miller.

The drawing shows how an arrangement of this kind was used on a machine operated at about 4,200 revolutions. At first only one belt, a 5-inch, three-ply rubber one, was used, but this soon began to break. It was laced as loosely as possible, and a tightly laced single leather belt, 6 inches wide, placed on top. When the machine was idle the two belts remained close together; but at work the inside belt sagged on the top or loose side about three to six inches below the outside belt, as shown in the diagram.



Showing Arrangement of Belts

After being in use for about two months the inside belt broke. When it was again laced up it was very tight and would run off the pulley as soon as the machine was started, showing that the inside belt should be loose and the outside one tight. In the case referred to, the outside belt traveled about six inches per revolution faster than the inside belt.

A crude-oil burning smelter established at Los Angeles has stood a successful test on a run of a quarter of a ton of copper ore.

An Irishman who was visiting America for the first time was lost in admiration of the Niagara Falls, when a friend accosted him:

"Well, Pat, and what do you think of this? Isn't it a grand sight? There's nothing in the old country to come up to it. See how it falls."

"Faith, I see how it falls," said Pat; "but, shure, there's nothin' to hinder it!"

The New York Central Railroad will spend $25,000,000 in the reconstruction of its New York City terminal and in installing electric service within the city limits and suburbs.

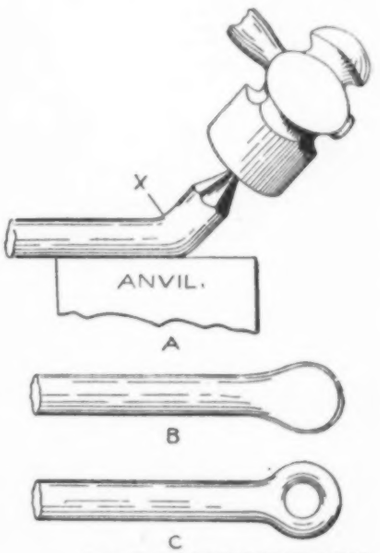
DEFINES ANNEALING.

The late Sir W. C. Roberts-Austen defined annealing "as the release of strain in metals which may itself have been produced by mechanical treatment, such as hammering, rolling or wire-drawing, or by either rapid or slow cooling from a more or less elevated temperature."

HOW TO FORGE AN EYE.

The following is a good method of forging an eye for chain-hooks, braces, eyebolts, etc., when the whole strength of the rod is wanted in the eye:

Take a soft heat on just the end of the rod (using a hammer of good weight), point it a little, and bend down over corner of anvil. Next turn the point up and strike as in Fig. 1, A, so as to upset the bent part down even with the rod, as in Fig. 1, B. Take care not to get a cold shut. Turn it over and punch as quickly as possible, rounding up on the horn of anvil.



FORGING AN EYE FOR CHAIN-HOOKS, BRACES, EYEBOLTS, ETC.

With a little experience, you will make a good, strong job, and at one heat, too.

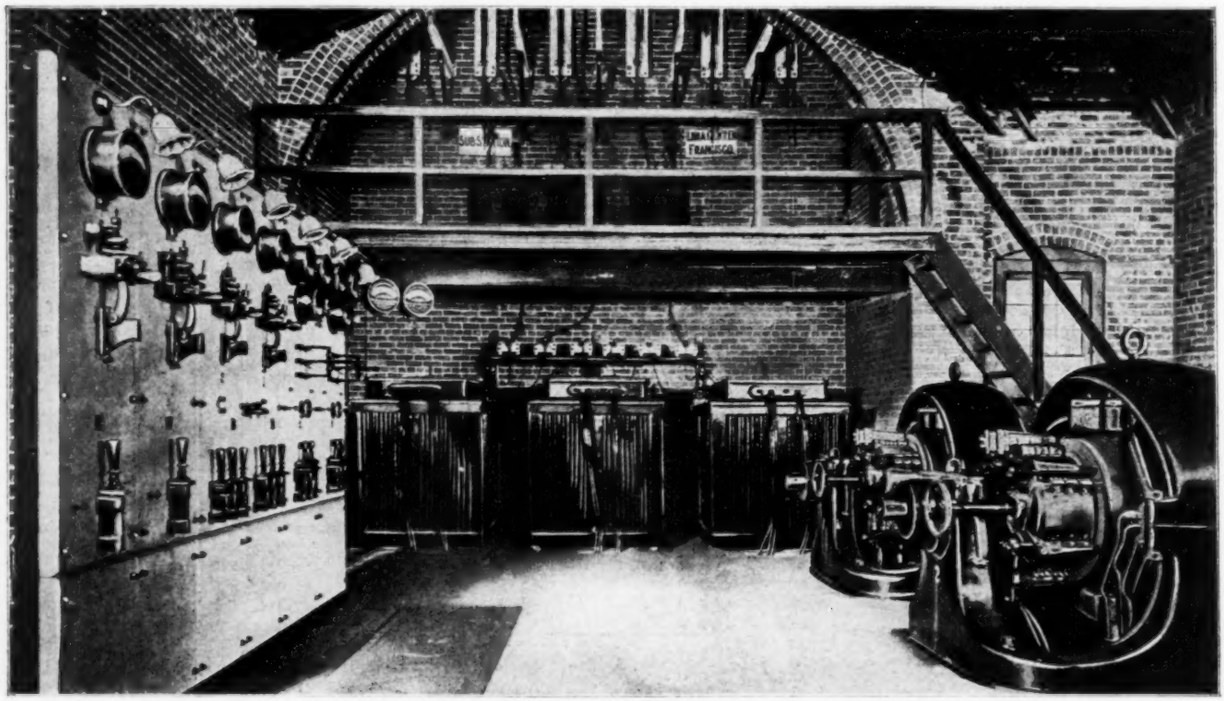
A Boston firm proposes to make paving bricks and railroad ties from old leather, ground, pressed and dried. With leather in the track a tie pass ought not to be so hard on shoes.

Contracts will shortly be placed in the United States, says Tropical Truth, for the equipment of 17 miles of electric traction in the city of Monterey, Mexico.

ELECTRIC RAILWAY SERVICE, PART IV.—TRANSFORMING 22,000 VOLTS DOWN TO 600.

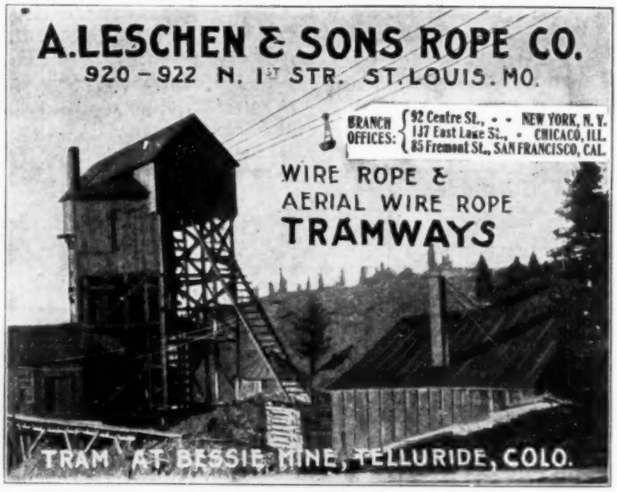
One of the Most Interesting and Valuable Feats of Modern Electrical Engineering.

The electric current in use on street railway cars to operate the motors under the car and furnish the light to find the straps, is called a direct current. This direct current is the same as makes the light in the incandescent lamps in our homes, only the railways have to have it from 500 to 600 volts strong, while 120 volts makes a good current for domestic purposes. Now this direct current is a steady, even tempered affair, compared to the alternating current, and flows along smoothly like water in a pipe. The alternating current, on the contrary, is made of vibrations, or throbs first out and then back, and is the kind which makes the average arc light, which is about 2,000 volts strong. Even at the same voltage, or strength, it is more deadly than the direct current, and its movement might well be compared to a fierce torrent, like the Niagara rapids, or an automobile, to take a more familiar illustration. The alternating current, however, can be sent or transmitted long distances along a very small wire, while to transmit the same power of direct current an equal distance would require a wire as large around as a man's body. The car motors thus far constructed don't like the alternating current but will work with the direct. This had led electrical engineers to get around the motors by generating alternating current in powerhouses, or with water powers far removed from where the power is needed, and transmitting the alternating current to the points desired. At these points it is brought into a building called a substation, where it causes a big motor to revolve rapidly and this motor drives another machine of a different construction called the generator. The 20,000 or 25,000 volts that goes into the substation as alternating current comes out in a docile, well-behaved direct current of 500 volts, or whatever is wanted, and fit to use.



Interior of Substation]

The illustration shows one of these substations erected by the Westinghouse Company for the Detroit, Ypsilanti, Ann Arbor & Jackson railway. The direct current is fed into the third rail described in Part 1 of this series. The machines at the right are the rotary transformers; at the left are shown the meters and switches on the switchboard; the wires carrying the currents enter in through the arch at the end of the room, and below is the transformer bank, which subdues the alternating current somewhat before it goes to the rotary, or machine at the right. One man only is required on duty at a time and he has little to do unless something goes wrong then he gets very busy.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The success of the 20-hour trains between Chicago and New York has stimulated railroad men, and resulted in a definite plan which, when in operation, will transport a passenger from New York to San Francisco in just three and one-half days. To do this the line west of Denver will have to be reconstructed at many points, grades reduced, curves taken out and the track put in safe condition for high speed. The distance is 3,250 miles, which means an average speed of 39 miles an hour, not counting stops. This seems perfectly feasible for the present flyers average 48 miles an hour, so that the 2,340 miles west of Chicago would only have to average 36½ miles an hour to come within the 84-hour limit. Millions of dollars are being spent to attain this result, which in time of peace or war will be of immense advantage.

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ILLINOIS WORLD'S FAIR BUILDING

Illinois, it is claimed, will have the most costly state building at the St. Louis world's fair, excepting Missouri. More than $100,000 is to be expended on the structure, which in style of architecture, nature of exhibit and general appearance is to reveal to the world's fair visitors the greatness of the state of Illinois. Giant statues of Lincoln and Grant will stand on either side of the main entrance and the drum of the dome will be surrounded by great sculpture groups symbolical of agriculture and other industries of the state. The French Renaissance architecture has been observed in the building's construction and its general outline is that of a well-proportioned pyramid. The building was designed by Watson & Hazleton of Chicago.

The Illinois Building

Plans have been made for 30 new cotton mills in the south with a capitalization of $1,447,600.

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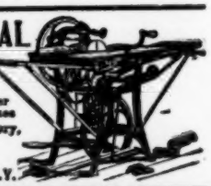

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"GYPSY," THE WANDERER OF THE LAKES.

Here is the gasoline launch, Gypsy, which it is said can beat anything of its size on Lake Michigan. The Gypsy is in many respects a wonderful little craft. True to its name it is something of a wanderer. Although yet young it has in its voyages made all the principal ports of Lake Michigan and has not yet experienced an accident worthy of mention. Its owner, William Anderson, 221 Vilas place, Chicago, says:

The "Gypsy" at Lincoln Park

"In a recent trip we covered over 300 miles on the lakes without the slightest hitch. We took in on this trip St. Joseph and Benton Harbor, Mich., Michigan City, Ind., and South Chicago, Ill. In our whole trip our engine gave us not a particle of trouble. The launch is 28 feet long over all with a beam of 6 feet 6 inches and is equipped with a double-cylinder gasoline engine of 7-horsepower. It has a special reversing gear and solid propeller wheel. Either cylinder of the engine will turn the wheel, but, of course, cannot propel it as fast as can both together.

The picture herewith shown was taken in the lagoon of Lincoln park, Chicago, opposite the Grant monument.

AUTOMATIC CHEMICAL EXTINGUISHER.

An automatic chemical extinguisher that promises to be of great service in reducing losses by fire has been invented by George C. Hale, former chief of the Kansas City fire department, who is the inventor of the swinging harness, the water tower, automatic alarm and other devices in use by fire departments all over the world.

The invention is in the nature of an addition to or an improvement of the Babcock chemical extinguishers, but instead of the small tanks which firemen carry into burning rooms the Hale plan contemplates the installation in a building of stationary chemical tanks capable of holding 500 or 1,000 gallons, if necessary. The automatic chemical extinguisher is also to be connected with an automatic alarm, so that when a fire breaks out and sets the extinguisher in operation the fire department will be notified of the fact at the same time.

OIL AS THE FUEL FOR NAVIES.

Oil is making wonderfully rapid headway as a fuel for ocean steamers, both freight and passenger. Popular Mechanics within the past three months chronicled the arrival of the first steamer to cross the Atlantic making steam from oil fuel alone. It now appears the question has received much more attention by foreign navies than had been supposed, and with the probable adoption of oil by some leading power, its use will then rapidly spread to the merchant marine and coal will cease to be the universal fuel at sea, as at present.

Russia is thus far in the lead, having equipped her Caspian sea fleet with oil burners and tanks, and is about to install the same in the fleet on the Black sea. England is experimenting on a destroyer, with oil as an auxiliary to coal, but thus far so much smoke has been made as to constitute a great disadvantage if in active service, where secrecy of position is desired.

The Swedish government is now building a fast torpedo-boat destroyer which will burn oil.

The Dutch government is experimenting with a torpedo-boat, the present intention being to use the oil as an auxiliary fuel when a sudden spurt of speed is needed. The oil is stored in tanks on deck where it would run into the sea without danger to the ship if the tank was pierced by a shot.

Germany is using both oil and coal on several vessels, the oil being carried in the double bottom of the ships, and Texas oil has taken the place of "masut" or tar oil. The Texas oil burned by the Durr system makes no smoke whatever, the oil being gassified before burning. France, Italy and Holland are conducting extensive experiments.

The Dutch East India Co. pronounce their experiments a success and entirely satisfactory and its large fleet will be equipped for oil. During a five-hours' trial in the open sea absolutely no work had to be done in the fire room. The oil is sprayed with a pump pressure of 40 pounds, no steam being used in the burners.

The above data is abstracted from a report on "Notes on Naval Progress," issued by the Office of Naval Intelligence, Washington.

Oil burning on shipboard is still in its infancy, and the field offers a very attractive study to the inventor.

Bids are being invited for the installation of an electric lighting system in Santiago de Cuba.

"Money is the coming king, and the American dollar will be the emperor of the world."—W. T. Stead.

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HOW TO REPAIR OLD PORCH CHAIRS.

When the cane back or seat of a porch chair gives out, the chair is usually thrown away as no longer of any use. The Metal Worker tells how the chair can be repaired at an expense of about 18 cents for material.

For the back a piece of No. 26 black iron is cut 2½ inches longer than the distance from center to center of the top and bottom rails to which the splints were

Porch Chair After Repairs are Made

woven and 1½ inches wider than the distance between the two upright posts. The long sides are each turned up square ¾ inch in the brake and slipped in place between the posts, with the turned edges facing back, notching out around the top and bottom rails. The extra material at the ends is rolled around and behind the rails and ¾-inch wire nails are driven through the sheet iron into the rails and side posts. As the nailing is all done at the back a smooth finish is presented in front. The same procedure may be followed for the seat, except that the sides should be turned up about 4 inches and slit down in cuts about 2 inches apart. Any desired curvature may be given to the seats, and the edges may be trimmed square and rolled around to the under side of the rail and nailed as before. The work may be suitably finished in paint or enamel.

HIS NARROWNESS.

They call him close and mean
  Because he saves day after day,
And never at the bar is seen
  Tossing his hard-earned coin away—
Last night he made an orphan glad
And bought the store a cripple had.

They call him niggardly
  Because he lives on frugal fare;
They dress in handsome style, while he
  Finds cheap clothes good enough to wear;
Where many a widow's light is dim
A prayer goes up each night for him

They call him mean and small
  Because he fails to find the joys
Of loitering where sirens call,
  And "making merry with the boys"—
Where palsied men and blind ones dwell,
They've learned to know and wish him well.

He toils day after day,
  They call him drudge and close and cold;
He may be narrow, as they say,
  And niggardly and little-souled—
They call him mean, but in the eyes
Of God he may seem otherwise.

S. E. KISER.

MONSTER GUN AT SANDY HOOK.

There has just been completed at Watervliet a monster gun which it required four years to build. It is to be stationed at Sandy Hook. So huge is this gun that new machinery had to be made to construct it and a new crane to handle it. With 1,000 pounds of powder it will send twenty-one miles a projectile weighing 2,370 pounds, and it is calculated that it will send that same projectile through 27.5 inches of steel at a distance of two miles.

The monster gun when it is placed in position at Sandy Hook will represent an outlay of $155,400. Of this sum $130,000 represents material and machinery, $20,000 labor, and $54,000 cost of transportation. The expense will not end with this outlay. There must be the cost of hoisting the giant and of keeping its complicated apparatus in order. Each time it is fired it will cost $865.

BANQUET ON HORSEFLESH.

Sixty well-groomed horses which had feasted for weeks on clover and oats provided the menu at a remarkable banquet attended by 600 guests that was given recently by the Berlin Society for the Prevention of Cruelty to Animals.

The menu comprised horsebone soup, pickled horse tongues, fillet of mare in Madeira sauce, and roast leg of filly. The guests ate double portions with unmistakable relish. Members of the reichstag, aldermen, and representatives of art and literature were among the company.

The purpose of the banquet was, by convincing the diners of the palatableness and wholesomeness of horseflesh, to induce horse owners to save their old horses from ending their years in ill-used drudgery by feeding them under healthful conditions until they are fit for the table.

One of the speakers said that 30,000 horses had been butchered and eaten in Berlin in 1902, and he hoped that the number would soon be ten times as many.

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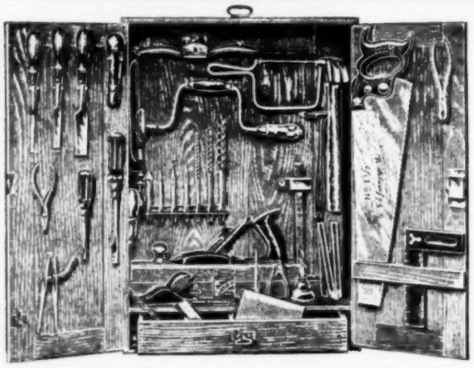

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